

wherein M is either nitrogen or phosphorous; and R₁, R₂, R₃, and R₄ are independently organic and/or oligomeric ligands or hydrogen.

33. (New Claim) The nanocomposite of claim 1, wherein the layered clay material has been treated with an alkyl or alkoxyated ammonium cation .

REMARKS

Claims 1, and 3-31 were pending in the application. Support for new claims 32 and 33 relating to particular organic cations may be found in the specification on pages 22-24. In view of existing claims 8 and 13, which already recited organic cations, and the rejections and responses already of record relating to the issue of organic cations, entry of new claims 32 and 33 would not require a new search, or raise new issues, will place the claims of the application in condition for allowance, or in better condition for appeal. Therefore, entry of new claims 32 and 33 is proper. After entry of the two new claims, claims 1 and 3-33 will be pending in the application.

A. Response to Restriction Requirement

In Applicants' previous response, Applicants did not assert that claim 22 had not been rejected. Applicants merely attempted to clarify what appeared to be a typographical error, in that claim 22 was shown as part of both groups I and II in the original Office Action. Applicants merely sought to confirm that claim 22 was not a part of non-elected restriction Group II. Given that the Examiner has again rejected claim 22, Applicants presume that claim 22 was and is under examination as part of provisionally elected group I, unless the Examiner states otherwise.



ATTORNEY DOCKET NO.: 05015.0302
SERIAL NO. 09/583,120

B. Claim Rejections for Indefiniteness Under 35 U.S.C. §112

Applicants thank the Examiner for withdrawal of the rejections under 35 USC 112(2) for indefiniteness with respect to the Markush language.

Applicants are puzzled by the reference in the current Office Action to a rejection for language regarding "Wyoming-type" clays. While that language appears in the current specification, and has appeared in both the specification and claims of some of Applicants' co-pending applications, the "Wyoming-type" language is not present in the current claims. Therefore Applicants presume that no rejection of the claims on that basis is pending, at least until the Examiner states some other basis for a rejection and/or objection.

C. Rejections Under 35 U.S.C. §102

Applicants thank the Examiner for withdrawal of the rejections of claims 1-2, 5-8, 10-12, and 14-17 for anticipation over Pinnavaia (U.S. Pat. No. 6,017,632).

D. Rejections Under 35 U.S.C. §103

The current Office Action finalizes the rejections of claims 1-2, 5-8, 10-12, and 14-17 under 35 U.S.C. §103(a) as allegedly being obvious over Pinnavaia (U.S. Patent No. 6,017,632) in view of Clarey (U.S. 6,050,509). The current Office Action also finalizes the rejections of claims 3-4, 13-14, 18, and 22-30 as allegedly being obvious over Pinnavaia and/or Clarey, in view of Beal (U.S. Patent No. 5,552,469), and finalizes the rejections of claim 9 as allegedly being obvious over Pinnavaia, Clarey, and/or Beal, further in view of Maxfield (WO 94/11430).

A basic flaw in each of the outstanding rejections is that the Office Actions selects individual components from among the various references, from various sections of the disclosures, from various disparate embodiments, and/or from large genres, as required to match the individual elements of Applicants' claims, without providing adequate motivations for the selection of the particular combination of components.

In order to establish a legally valid *prima facie* case of obviousness, the art of record must teach or at least suggest the particular combination of elements as a whole. It is well

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established law the Commissioner may not merely locate the individual elements of an Applicants' invention somewhere in the prior art.

"...there must be some motivation, suggestion, or teaching of the desirability of making the specific combination that was made by the applicant...[omitted citations]. Even when the obviousness is based on a single prior art reference, there must be a showing of a suggestion or motivation to modify the teachings of that reference....

Whether the Board relies on an express or implicit showing, it must provide particular findings related thereto. *See Dembiczak*, 175 F.3d at 999, 50 U.S.P.Q.2d at 1617. Broad conclusory statements standing alone are not 'evidence....'

...there was no finding as to the specific understanding or principal within the knowledge of a skilled artisan that would have motivated one with no knowledge of Kotzab's invention to make the combination in the manner claimed." *In re Kotzab*, 217 F.3d 1365, 55 USPQ2d, 1313, 1316-1318 (Fed Cir. 2000). (emphasis added)

Furthermore, there must be a motivation or suggestion for each selection and/or modification required to combine the elements of the claims from the prior art. *See Yamanouchi Pharmaceutical v. Danbury Pharmaceutical*, 231 F.3d 1339, 1343-1345, 56 U.S.P.Q.2d 1649 (Fed Cir. 2000).

In response to the First Office Action, Applicants amended some of the claims, and made arguments as to why the first Office Action failed to carry its burden to present a valid *prima facie* case to reject the amended claims. The current Office Action attempts to rebut some of Applicants' arguments. Applicants answer many of those rebuttals below. Applicants continue to maintain that neither the first nor the pending Office Action carried its burden to identify and properly support with objective evidence a valid basis for a *prima facie* rejection of Applicants' pending claims.

Obviousness Rejections Over Pinnavaia In View of Clarey

Claims 1-2, 5-8, 10-12, and 14-17 are rejected as allegedly being obvious over Pinnavaia in view of Clarey.

Pinnavaia's invention and focus relates to the intercalation of clays (in their acidic form) with certain electrically neutral, organic, and basic "curing" agents, and the subsequent reactions of those intercalated clays with monomers to initiate polymerization/curing, to produce a large genus of nanocomposites comprising "cured" thermoset polymers, such as polyurethanes, polyureas, polysiloxanes, and alkyds (*see* column 10, lines 23-36). In a single paragraph in column 11, Pinnavaia also states that "All thermoplastic polymers can benefit from the disclosed technology." Pinnavaia then enumerates a list of 19 large genres of thermoplastic polymers to which his clay / intercalated curing agent technology, might apply, of which one subgenus is the polyamides recited by Applicants' pending claims.

The Office Action relies on Pinnavaia's reference to "technology" to provide motivation to (1) select the polyamides from the Markush group of thermoplastic polymers (*see* the Office Action's response items c and g), and (2) combine it with a single sentence from Example E2 regarding sedimentation a clay sample to "remove" quartz (*see* the Office Action's response items a and d). Applicants traverse that allegation as follows.

The "technology" of Pinnavaia relates to the intercalation of an acidic clay with a basic organic curing agent. The curing agents aid exfoliation of the clay, and can initiate polymerization of the preferred class of thermoset polymers, as described by Pinnavaia at length. The overwhelming bulk of the specification, including the examples to be discussed later, focus on the curing agent / clay / thermoset polymer "technology." As a "alternative" sidelight in column 11, Pinnavaia also suggested his clay / intercalated curing agent "technology" might be useful with respect to thermoplastic polymers "wherein the polymer melt may bind by entanglement," even though such pre-polymerized thermoplastic polymers that would not benefit from the "curing" activity. Applicants deny that Pinnavaia's mere reference to "technology" can be reasonably construed as either a reference to, or a teaching or motivation to select and combine, (1) the polyamides selected from the Markush group of thermoplastic polymers, with

(2) the single sentence from Example E2 regarding “The Na⁺ montmorillonite was purified by sedimentation to remove quartz and other dense, large grain contaminants.”

First, neither Office Action identifies a sufficiently specific motivation to select polyamides from among the large genres of thermoset and thermoplastic polymers disclosed by Pinnavaia. A mere reference to “technology” in this alternative embodiment does not justify a selection of polyamides from among all the thermoset polymers from among the 19 enumerated classes of thermoplastic polymers. The Office Actions identified no other reasonable motivation for the selection of polyamides, from Pinnavaia or any other source.

The “removal of quartz” from clays is mentioned nowhere in Pinnavaia except Example E2. Example E2 describes an unsuccessful attempt to prepare a nanocomposite via Pinnavaia’s “technology” from an Na⁺ montmorillonite clay, in which “There was no observable intercalation of the clay by the curing agent and epoxy resin.” Example E2 does mention, in a single sentence, removal of quartz. The relevant sentence reads, “The Na⁺ montmorillonite was purified by sedimentation to remove quartz and other dense, large grain contaminants.”

The Office Action asserts in its comments “a” and “d” that quartz was “removed completely” or “eliminated” from the clay. Applicants deny any such inference. “Removal” merely implies that some quartz was separated from the clay. The only process mentioned in Pinnavaia was sedimentation, “to remove quartz and other dense, large grain contaminants.” One of ordinary skill could not reasonably infer from this sentence that sedimentation “completely” removed or “eliminated” even “small” grains of quartz, or that any particular percentage of quartz removal was or will always be obtained, especially in view of the highly variable compositions of natural clay samples. Moreover, none of the other references cited by the Office Action (including Clarey) assert that all quartz is removable from clays. Moreover, Example E2 was unsuccessful in its attempt to employ Pinnavaia’s curing agent “technology,” which would tend to lead one of ordinary skill away from attempting to apply its teachings to the present invention. The Office Action mis-interpreted and over-interpreted the sentence from Example E2.

In Example E3, a “purified” Na⁺ montmorillonite clay was treated with NH₄⁺ cations, which were then intentionally thermally decomposed, to produce an acidic form of the clay, then the clay used in Example E4 to prepare “a conventional clay-epoxy composite.” In Example E5, an example of an epoxy nanocomposite was prepared using the Pinnavaia “curing agent” technology, and compared with an epoxy-clay nanocomposite prepared from an Na⁺ montmorillonite clay that had been intercalated with alkyl ammonium ions. There is no indication in Example E5 as to whether or not the clays in the clays were “purified,” and it is noted that the presence of the alkyl ammonium in clay gallery of the comparative sample “decreased the effectiveness of the clay reinforcement.”

Applicants’ deny that one of ordinary skill in the art would read this sequence of examples and interpret them as teaching or suggesting the importance of “removal of quartz,” or that “complete removal of quartz” was a significant part of Pinnavaia’s “technology.” Moreover, this sequence of examples provides no suggestion or motivation to modify Pinnavaia’s examples or technology to achieve any particular low total concentration of quartz such as the “less than about 2% by weight of quartz” recited by Applicants’ claims, especially in view of the negative results obtained in Examples E2 for the Na⁺ montmorillonite clay nanocomposite, and the alkyl ammonium ion intercalated clay of Example E5.

In its comment “a”, the Office Action asserts that it is somehow Applicants burden to rebut an alleged *prima facie* showing by the Office Action on this quartz “removal” issue, a position that is clearly incorrect. It is the Commissioner’s burden to establish a *prima facie* case that the prior art teaches or suggests the particular combination of elements of Applicants’ claims, and support that rejection with objective evidence. See *In re Kotzab*, and *Dembiczak*, as cited above. Speculative and highly questionable interpretations of Pinnavaia’s examples, and the words “removal” and/or “technology,” without more, do not establish a valid basis for a *prima facie* rejection. It the Office Action, not Applicants, that repeatedly attempts to rely on “statement and opinion.” The “statements and opinions” of the Office Action have not successfully shifted the burden of proof to Applicants.

Applicants' previous response pointed out that while Clarey discloses removal of generic impurities to the various particular levels, Clarey provides no specific teachings regarding the quantities of quartz impurities. Applicants also objected to the attempts of the first Office Action to infer, without specific basis in Clarey, a negative effect on haze, discoloration, transparency, or clarity. Applicants also objected to hindsight-based embellishments of Clarey's actual teachings. Applicants re-iterate and amplify those objections as follows. The outstanding rejections rely on combining Clarey with Pinnavaia to provide Applicants' claim limitations regarding "less than about 2% by weight of quartz." Clarey describes a method for purifying clays for use in nanocomposite applications, to remove a variety of impurities. Although Clarey suggests that any clay can be purified, at column 3, line 60 through column 4 line 11 Clarey specifically remarks on the problems encountered in attempts to apply his purification methods to Na⁺ montmorillonite clays, and suggests such clays be converted to Ca²⁺ clays prior to purification by his method. Thus, one of ordinary skill in the art would have little, or perhaps even negative motivations with respect to the prospect of applying Clarey to modify the disclosures of Pinnavaia's examples, regarding Na⁺ montmorillonite clays, which themselves contain negative motivations, as described above. In contrast, Applicants' specification and claim 8 specify the preferred use of Na⁺ montmorillonite clays.

In response item "b" on page 6 of the current response, the Office Action attempts to rely on the "examiner's fast learning curve and knowledge that the presence of the impurity would be very visible during the blow molding, since quartz would not stretch the thermoplastic." In its response item "h," the Office Action admits that "any judgment on obviousness is in a sense necessarily a reconstruction based on hindsight reasoning," and seems to cite *In re McLaughlin* for the proposition that hindsight reasoning is permissible as long as it only employs "knowledge that was within the level of ordinary skill in the art at the time," and "does not include knowledge gleaned only from the applicants' disclosure."

These statements mis-state and mis-apply the law of obviousness. Hindsight-based reasoning is not legally permissible¹. Employing information from Applicants' disclosure clearly is impermissible, as it constitutes the essence of hindsight-based reasoning. The Examiner's current "fast learning curve and knowledge" is irrelevant to what one of ordinary skill in the art would have found obvious at the time of the invention, unless supported by specific and objective evidence that such knowledge or theories existed at the time. See MPEP § 2144.03. It is precisely Applicants' point that the Office Actions have failed to carry their burden to specifically demonstrate, and support with objective evidence, that the relevant information and/or assertions were within the knowledge of one of ordinary skill in the art at the time of the invention. Again, it the Office Action, not Applicants, that attempt to rely on "statement and opinion," and hindsight-based reasoning.

In comment "g" on page 8, the Office Action cites a 1972 CCPA case, *In re Lindner*, for a proposition that it is "well settled law" that two ingredients known in the prior art to be "useful for the same purpose" can be validly combined to support a *prima facie* case of obviousness. *In re Lindner* actually held that the combination of two known dispersants was *prima facie* obvious, because one of ordinary skill in the art would, based on the known and common dispersing property, have motivation to consider a combination of the two old dispersants. The Office Action attempts to broaden *Lindner* by using a phrase "same purpose" that does not appear in *Lindner* by seeming to assert that any combination of ingredients that has been used to prepare a nanocomposite in any available reference is *prima facie* obvious. Any such broad assertion is clearly not the law, especially in view of the much more recent case law cited by Applicants elsewhere herein. More specifically, the Office Action seems to attempt to apply *Lindner* to support a proposition that Cleary, which teaches regarding levels of clay impurities that may be used in making nanocomposites, but teaches virtually nothing about polymers, provides a teaching, suggestion, or motivation to select polyamides from among the many polymers

¹ "Our case law makes clear that the best defense against the subtle but powerful attraction of hindsight-based obviousness analysis is the rigorous application of the requirement for a showing of the teaching or motivation to combine the prior art references." *In re Dembiczak*, 175 F.3d 994, 999 (Fed. Cir. 1999).

disclosed in Pinnavaia, merely because Cleary relates to clay containing nanocomposites. Any such argument is a serious misapplication of *Lindner*.

The Office Action points to U.S. Patent No. 6,337,046 to Bagrodia, and U.S. Patent No. 6,090,734 to Tipursky as support for its theories regarding the effects of specific levels of “impurities” on haze and other properties. Tipursky does teach that amorphous silica negatively impacts haze and gas permeability. Nevertheless, neither Bagrodia or Tipursky specifically teaches that quartz at any particular concentration impacts haze and gas permeability. Applicants’ claims have not been rejected over either of those references.

Moreover, even if one or more of Clarey, Bagrodia, and/or Tipursky were properly combinable with Pinnavaia, which they are not, and they taught relevant specific percentages of quartz, which they do not, Clarey, and/or Tipursky have no relevant teachings regarding polymers. Bagrodia teaches polyester nanocomposites, but does not teach or suggest that polyamides be employed. Therefore, none of Clarey, Bagrodia, and/or Tipursky remedy the failure of Pinnavaia to provide a basis for selecting polyamides from the large number of polymers disclosed in Pinnavaia, or suggest a basis for modifying the Examples E2-E6 to discard the explicitly recited epoxy polymers, and substitute polyamides.

Obviousness Rejections Over Pinnavaia and Clarey, over Beall

The Office Action finalizes the rejections of claims 3-4, 13-14, 18, and 22-30 as allegedly being obvious over Pinnavaia and/or Clarey, in view of Beal. The Office Action asserts in item “i” on page 9 that Pinnavaia teaches polyamides, that polyamides “contain appropriate monomeric components” that are known to those of skill in the art as applicable to nanocomposites, that Beall “teaches polyamides more specifically,” and that these observations, by some non-specified reasoning, establish a *prima facie* case of obviousness.

Applicants do not deny that both Pinnavaia and Beall disclose polyamides in the context of nanocomposites, or that those of ordinary skill in the art are aware of “appropriate monomeric components” for making polyamides. Nevertheless, Applicants re-iterate that merely identifying the individual elements of Applicants’ claims in one or more references, or in the knowledge of

one of ordinary skill in the art, is legally insufficient to establish a *prima facie* case of obviousness. The Office Action must specifically identify and support with objective evidence a teaching, motivation, or suggestion to select and combine the references. See *In re Kotzab*, cited hereinabove.

In item “i” on page 9, and in item “h” on page 8, the Office Action attempts to rely on the knowledge of one of ordinary skill in the art to provide motivation to combine Beall and/or Cleary with the other references. MPEP §2144 permits the Office to rely on “common knowledge in the art,” “implicit disclosures,” and/or “scientific principals.” Nevertheless, the case law, MPEP §2144, MPEP §2144.02 and MPEP §2144.03 also require that when the Office relies on such grounds of rejection, “the examiner must present convincing line of reasoning supporting rejection.” If an Applicant traverses such assertions, the Commissioner must respond with “evidentiary support for the existence and meaning of that theory.” In view of Applicants discussion of the technical teachings of the references, Applicants deny that the Office Action has adequately identified or defined motivations, or specific and convincing reasoning for combining the three references, selecting the individual elements of Applicants’ claims from any of the three references, or provided any objective evidence to support such motivations or reasoning. Therefore the Office Actions have failed to establish a proper *prima facie* rejection of Applicants’ claims over Beall, Pinnavaia and/or Clarey.

Rejections Over Pinnavaia, Clarey, and Beal in View of Maxfield

Claim 9 is finally rejected under 35 USC 103(a) as allegedly being obvious over Pinnavaia, Clarey, and/or Beal, in view of Maxfield (WO 94/11430). The current Office Action does not address Applicants’ previous argument that the first Office Action did no more than identify some of Applicants’ claim elements in Maxfield. However, as previously stated, the mere identification of the various technical features of the claims in one or more references does not provide legally sufficient motivation to select the specific combination of the features of claim 9 from the four references. Therefore, the Office Action has not carried its burden to provide a valid *prima facie* rejection of claim 9.

Overall, a showing that Pinnavaia, Clarey, Beall, and/or Maxfield renders Applicants' amended independent claims obvious would require the Office Action to at least show, and support with objective evidence, that one of ordinary skill in the art would have motivation to select and combine, from the whole disclosure of Pinnavaia, in view of the other references (1) the sentence from Pinnavaia's Example E2 regarding sedimentation of clay, (2) modify the sedimentation mentioned by Pinnavaia to provide Applicants' limitation to "less than 2% quartz, (3) modify the epoxy polymers utilized in Examples E3-E6, and/or the general set of thermoset polymers emphasized by Pinnavaia, to employ (4) a specific selection of a polyamide from among the 19 classes of thermoplastic polymers. To produce a valid *prima facie* rejection for obviousness, there would need to be motivation or suggestion from some source for each of these selections and/or modifications. The Office Action has not adequately and specifically identified motivations to justify any of these selections. Therefore, the Office Action has not carried its burden to provide a valid *prima facie* rejection of any of Applicants' independent claims.

Applicants' dependent claims 8 and 13, and new claims 32 and 33 also require the clays of the nanocomposites to be treated with an organic cation. Applicants previously argued that Pinnavaia taught away from the use of organic cations, based on the disclosures at column 4, line 62 through column 5 line 7, and the comparative sample prepared from an alkyl ammonium ion exchanged clay cited in Example E5 at column 20, lines 51-61. Applicants have also argued that the treatment of clays with NH_4^+ ions disclosed in Example E3 are irrelevant, because the NH_4^+ cations are not organic, and moreover they are intentionally thermally decomposed in the example, to produce an acidic clay having a 10.5 Å spacing. In its comment "e", the Office Action discounts Applicants' argument that Pinnavaia teaches away from the use of organic cations, because cations such as ammonium cations will exchange with clays. Applicants do not deny that NH_4^+ ions or alkyl ammonium ions intercalate clays. However, that does not change the fact that Pinnavaia taught away from the use of organic and/or alkyl ammonium ions in his nanocomposites. See Example E5. The Examiner must consider Pinnavaia's teaching away from the use of organic cations when considering the obviousness of Applicants' claims 8, 13, 32, and 33.

ATTORNEY DOCKET NO.: 05015.0302
SERIAL NO. 09/583,120

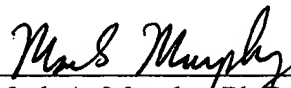
CONCLUSION

Pursuant to the above remarks, all the rejections stated in the Office Action have been overcome, and reconsideration and allowance of the pending application is believed to be warranted.

Enclosed is a Credit Card Payment Form in the amount of \$36.00, for the two new and additional dependent claims. No other fees are believed due. However, the Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 14-0629.

Very truly yours,

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